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The Effect of Five Philosophies on Industrial Arts Education

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THE EFFECT OF FIVE PHILOSOPHIES
ON
INDUSTRIAL ARTS EDUCATION

A PAPER

Submitted in Partial Fulfillment of the Requirements
for the Degree Master of Science in the Graduate
Program of Eastern Illinois State College

By

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PREFACE

The present phase of industrial arts is regarded as a third period of development which is still experiencing changes. The first period was named manual training by John D. Runkle in 1877 and the emphasis was on hand skill. About 1894, the philosophy had been extended to include the making of both useful and well-designed articles, and manual training became known as manual arts. The influence of industry became so great that, by 1910, the field was referred to as industrial arts.

The development of the present concept of industrial arts in general education has been influenced by a number of philosophies and practices. It has developed through the years by retaining parts of the old systems which were good, and by introducing new concepts to meet the needs of the time.

The purpose of this paper is to show the effects of five philosophies on the present concept of industrial arts.

CHAPTER I

DELLA VOS AND THE RUSSIAN SYSTEM OF ENGINEERING TRAINING

Prior to the last half of the nineteenth century there had not been an effective system or method of teaching the manual or industrial arts. The imitative or apprenticeship method of passing on knowledge was generally used. By 1850, the apprenticeship method became less commonly used. The industrial revolution introduced new machines and mass production. People found it more profitable to work in factories. New jobs were created which called for more technically trained and skilled workers. There was a consciousness of the lack of an adequate method of giving instruction and training in the mechanic arts. Trade and technical schools of one hundred years ago began to realize that practice in using tools given with related theory would produce more efficient mechanics and engineers in a shorter period of time. Russia was the first to put into practice the idea of "analyzing tool practice into its elements and teaching the elements abstractly to a class. In their hands, manual

tool instruction has become a science."¹

In 1830, the Russians established a School of Trades and Industries in Moscow. Later, in 1868, the School of Trades and Industries was reorganized and became known as the Imperial Technical School of Moscow. The school's purpose was to train civil engineers, draftsmen, foremen and chemists.

In 1868, the director of the Imperial Technical School, Victor Della Vos, and his shop instructors, began working out a system whereby theoretical instruction and practical instruction could be provided in the workshops.

Della Vos was aware of the inadequacy of the old "self-teaching" practices, and wrote:

Up to the present time throughout the world, the workmen at industrial works and mills are usually self-taught. Anyone who has himself been employed at a works and is familiar with the daily life of the workman in the different countries, must have perceived that the acquirement of knowledge and skill in any trade is to him a process much similar to the following: A boy of thirteen or fourteen years of age, having entered a mechanical works to learn his trade, is put during the first few years to work of an entirely un-productive kind and which has not the slightest relation to technics. He is made to carry water, sweep the workshop, crush emery, grind colors, etc. Only after the lapse of a few years and, proba-

¹Bennett, Charles A., History of Manual and Industrial Education 1870 to 1917, The Manual Arts Press, Peoria: 1937, p.322.

bly, thanks to accidental circumstances, a chisel or a file is put into the hands of the youth and he is set to perform the rudest and simplest kind of work.

Then, also, if he happen to have neither father nor brother among the workmen around him, he begins learning his trade without a guiding hand, and thus commences acquiring practical knowledge and skill in his trade by observing those about him in the workshop and by his own thought and calculation and impelled by the sole desire of attaining in as short a space of time as possible the position of a paid hand in the works.²

Della Vos was concerned with the fact that no attention was given to the manner in which the young workmen acquired practical experience in their trades at the works. Until new technologists leaving the polytechnical schools possessed rational experience in doing practical hand work, Della Vos realized that rational instruction of all working men would not be satisfactory. He developed his system of analysis on the principle that, "mechanical engineers and mechanical instructors, whose future activity will be devoted preeminently to mechanical works, should have practical experience in the mechanical arts."³

In order to teach the fundamentals of the mechanical arts successfully, Della Vos and his associates decided it was necessary to work out a new method of teaching

²Ibid., p. 48.

³Ibid., p. 49.

which: (1) would demand the least possible time; (2) would make it possible to give adequate instruction to a large number of students at one time; (3) would give to the study of practical shopwork "the character of a sound, systematical acquirement of knowledge"; and (4) would enable the teacher to determine the progress of each student at any time.⁴

It had been the practice of the Imperial Technical School to accept large contracts and do the work for private individuals through the employment of workmen and the labor of the students. The students learned by imitation or the apprenticeship method. In the new system of Della Vos, two separate shops were used. They had instruction shops and construction shops. After completing a required course in the instruction shops, the students were permitted to work in the construction shops. The instruction shop was a new feature never used before. By completing a course of prescribed exercises in the instruction shop, "based on a scientific analysis of shopwork processes, a boy could become a better mechanic in a much shorter time than if he worked in a factory on such productive work as he was able to do successively."⁵

Charles A. Bennett studied early statements of courses

⁴Ibid., p. 50.

⁵Ibid., pp. 42-3.

and methods concerning the Russian system of class instruction and analysis, and derived from them the following eight facts or rules:

(1) Each art or distinct type of work has its own separate instruction shop: e.g., joinery, wood-turning, black-smithing, locksmithing, etc.

(2) Each shop is equipped with as many working places and sets of tools as there are pupils to receive instruction at one time.

(3) The courses of models are arranged according to increasing difficulty of the exercises involved, and must be given to the pupils in strict succession as arranged.

(4) All models are made from drawings. Copies of each drawing are supplied in sufficient number to provide one for each member of a class. The drawings are mounted on cardboard (or, for the blacksmith shop, on wooden boards) and varnished.

(5) The drawings are made by the pupils in the class for elementary drawing, under the direction of the teacher of drawing with whom the manager of the shops comes to an agreement concerning the various details.

(6) No pupil is allowed to begin a new model until he has acceptably completed the previous model in the course. He must receive at least a grade of three, which is considered good.

(7) First exercises will be accepted if dimensions are no more than approximately correct; later exercises should be exactly to dimensions; therefore, the same mark given to a student at different periods during his course do not express the absolute, but the relative, qualities of his different pieces of work.

(8) Every teacher must have more knowledge of his speciality than is necessary merely to perform the exercises in the course of instruction. He must keep constantly in practice so that his work may be

an example of perfection to his pupils.⁶

The teaching of a course according to the system of Della Vos involved three successive "periods."⁷

First Period - The pupils were given the names of tools and told and shown how to use them. They practiced the fundamental methods of holding and using the tools, and were given subject matter information concerning the properties of the different materials they used.

Second Period - The pupils learned to combine the exercises mastered in the first period. For example, in wood-working they made a variety of typical joints used in construction. They always proceeded from the simple to the more complicated.

Third Period - The pupils made the whole or parts of various mechanisms as projects, either full size or to scale. Practical knowledge was acquired concerning the working of wood and metals.

It was customary to have the following items hung on the wall in the instruction shops of Russian schools:

(1) A board upon which were samples of the regular course of study pursued in that shop;

(2) A board to which was fastened one of the regular bench sets of tools, the name of each tool being

⁶Ibid., pp. 17-8.

⁷Ibid., p. 19.

on the board in large letters;

(3) Rules for the internal order of the shop, made by the manager of the shop and approved by the pedagogical conference;

(4) A list of the benches, vises, furniture, machines, etc., constituting the equipment of the shop; and

(5) The daily program of work.⁸

Each pupil, under the system of Della Vos, was expected to record the successive steps of procedure for each exercise in a workbook provided for his use. Individual help was given by the teacher after class instruction and demonstrations. All successive operations on an exercise piece had to be checked and approved before the pupil was allowed to do the next step. This was done to avoid excessive waste and to insure correctness in completed work.

Charles A. Bennett has summarized some of the results of this system as follows:

(1) It proved that the mechanic arts may be analyzed and their fundamental elements arranged in pedagogical order and taught as readily as the elements of music or drawing or mathematics or a language.

(2) It demonstrated that in teaching the mechanic arts, if the proper equipment is supplied, one teacher may successfully give instruction to a comparatively large number of young workers at one time.

⁸Ibid., pp. 18-9.

(3) It revealed, however, that class instruction alone is not sufficient to avoid excessive waste of material, to insure correctness in the completed work, and satisfactory progress in the worker. The conclusion was reached that individual help must be given in addition to class instruction and that, in the earlier stages of the instruction, each operation performed by a pupil should receive the teacher's approval before the next operation is undertaken.

(4) It maintained that the teacher must be an expert craftsman in the work he is teaching and must keep up his practice at his craft, so that he will not only give correct instructions, but that the work of his own hands will be an example and an inspiration to his pupils.⁹

By 1870, the plan was introduced into all the technical schools of Russia. When it became widely dispersed in Russia, teachers of technical subjects modified the plan to suit their teaching situations by adapting the instruction shop to local needs and disregarding or omitting in some situations, the factory work which included production in the construction shops.

A display of the Russian method of workshop instruction was shown in the Centennial Exposition in Philadelphia in 1876. A direct result of its presentation was the adoption of its principles by the St. Louis Manual Training School of Washington University.¹⁰ The later manual training schools in the United States analyzed tool processes by following the method established in the manual training

⁹Ibid., p. 46.

¹⁰Ibid., p. 42.

school in St. Louis. Scientific job and trade analysis has now been developed to the extent that present industrial arts has analyzed practically all trade and job areas whose subject matter is included in instructional situations.

Some other ideas and methods of teaching present industrial arts in the public schools are directly traceable to those used by Della Vos. The instruction shop idea is used in present day industrial arts, with modifications. Instead of providing tool work experience by constructing a series of graded exercises along with instruction as the Russians did, the industrial arts teacher has the pupil construct useful objects which involve the tools and processes under consideration. The unit shop in present day industrial arts comprises shop activity in a single area of work, such as wood, drawing, or metals; it most closely resembles the Russian idea whereby each distinct type of work has its own instruction shop. Class instruction is given to a number of pupils at one time, and is supplemented by individual instruction. The Russians were more concerned with class instruction for providing workers for mass production, and gave individual help primarily to avoid waste and to maintain correctness and progress in the work. Present industrial arts recognizes individual differences and gives individual help for personal development of the pupil.

Every teacher is expected to have more knowledge of his field than is necessary to perform the tool processes included in the course of instruction. The work should be an example of perfection to the pupil. The teacher is expected to continually extend his knowledge and skills; he is expected to have a thorough knowledge of any part of an area that he teaches to a class.

The present day industrial arts teacher is responsible for maintaining order in the shop. He may rotate pupils as "foremen" to assist him in checking the order of the shop. A plan or scheme for the assignment and rotation of the duties of the pupils is generally placed on a bulletin board or hung in the shop.

Theoretical instruction and practical instruction are provided in electricity, drawing and other instructional areas so the pupil can acquire more skill and understanding in a limited period of time.

Pupils are given the names of tools and told and shown how to use them. They are given information concerning the different machines and materials they use. Models and charts are used for demonstration purposes. They are used as visual aids when the teacher is giving demonstrations and explaining the function of different tools and their parts. The Russians used wooden models of types of drills and bits, and the like, for demonstra-

tion purposes. Today, the industrial arts teacher uses movies and slides, and visual aids made of plastics and other materials, for demonstration and informative purposes.

Tool panels are provided for those tools which are not part of the common bench sets. Some of the industrial arts shops of today place the names of tools on tool panels for the purpose of learning the names of tools by association.

Today, the pupil makes a useful article from a drawing which is either provided for him or is drawn by himself. The pupil of the plan of Della Vos made the exercise models from individual drawings which were provided.

CHAPTER II

OTTO SALOMON AND EDUCATIONAL SLOYD

Otto Salomon was born at Gothenburg, Sweden, November 1, 1849. He did not receive any special preparation for the work that later made him famous. His school education had been moderate. His early education was received in preparatory schools of Sweden. In 1868, he entered the Institute of Technology of Stolkholm. At the age of 23, he was placed at the head of the Sloyd schools at Naas.

August Abrahamson had opened a school at Naas in 1872. In 1869, he asked Otto Salomon, his nephew, to become a member of his staff at Naas. Salomon accepted the invitation, and attended the Ultuna Agricultural Institute until 1872 so he would be more fully prepared for the work.

From earliest times the people of northern Europe spent the long, dark hours of the winter at the fire side, fashioning all the needs of their house and homestead with their hands.¹¹

During the seventeenth century, there began a gradual decadence in the "home sloyd." With the advent of the

¹¹Farley, Allison A., "Swedish Sloyd," Manual Training Magazine, 8:148, April, 1907.

machine age came corresponding economic and social changes which broke down the old home life of the people. Railroads and communication lines were built, making the towns and villages less remote. Books could be had by even the poorest people. Articles of farm and home requirement could be had so cheaply the average peasant would not spend the long evenings at his useful pastime. The result was the breaking down of hand skills and character among the young people.¹²

An effort was made to bring back sloyd by establishing schools in which sloyd was taught. The pupils made what the market would purchase. Little reference was made to educational value. The handicraft schools were generally supported by private societies or individuals.

In 1872, the Parliament of Sweden passed a bill that gave money to schools promoting industrial work. At this time, Otto Salomon did much study and research. He visited other schools to get ideas. In 1877, he visited Finland and met Cygnaeus, the founder of the folk school system of that country. He received two ideas from Cygnaeus: (1) Sloyd should become an integral part of the elementary school course of instruction, and (2) Sloyd should be

¹²Rappaport, Benard F., "Swedish Sloyd," Industrial Arts and Vocational Education, 33:356, November, 1944.

organized on a pedagogic rather than an economic basis.¹³

Despite his studies and research, Salomon did not find an adequate or satisfactory method of organizing and teaching sloyd. The task before him was to develop a method of teaching sloyd that could contribute to the main purpose of the schools, which was general education. His study and work resulted in what is called educational sloyd.

There were many kinds of sloyd involving various materials such as wax, clay, paper, pasteboard, wood, metal, and others. For his plan of educational sloyd, Salomon decided to use wood-sloyd because it was the most suitable of all the media.¹⁴ Besides being easily available, clean, and commonly useful for making things in the home, wood was suited for the use of a variety of tools and many forms of construction.

Charles A. Bennett gives three outstanding characteristics of Salomon's educational sloyd.¹⁵ The first characteristic, making useful objects, was inherited from the early home sloyd when useful things were made for the home by the family at the fireside. The second characteristic, analysis of tool processes, probably was derived from the Russians.

¹³Bennett, op. cit., p. 64.

¹⁴Salomon, Otto, The Teacher's Hand-Book of Sloyd, Silver, Burdett and Company, Boston: 1904, p. 6.

¹⁵Bennett, op. cit., pp. 64-5.

The third characteristic, educational method, is attributed to Cygneaus of Finland. Finland is credited with being "the first country where manual training was acknowledged as a branch of instruction with full rights in the primary school."¹⁶ The success of educational sloyd in Sweden became known the world over.

Otto Salomon expressed his aims of educational sloyd in his book, The Theory of Educational Sloyd. Formative or character building aims were:

- (1) To instill a taste for, and a love of, labor in general.
- (2) To inspire respect for rough, honest, bodily labor.
- (3) To develop independence and self-reliance.
- (4) To train in habits of order, exactness, cleanliness, and neatness.
- (5) To train the eye and sense of form. To give a general dexterity of hand, and to develop touch.
- (6) To accustom to attention, industry, perseverance, and patience.
- (7) To promote the development of the physical powers.

Utilitarian aims were:

- (1) To directly give dexterity in the use of tools.
- (2) To execute exact work.¹⁷

Physical development played a larger part in educa-

¹⁶Farley, op. cit., p. 151.

¹⁷Salomon, Otto, The Theory of Educational Sloyd, Silver, Burdett and Company, Boston: 1900, pp. 6-7.

tional sloyd than it does in present industrial arts. Salomon had worked out a plan for the position of the body during work. He was concerned with equal development of both sides of the body. Sloyd carpentry, in conjunction with gymnastics, was considered necessary for physical training.¹⁸ Today, the industrial arts teacher is more concerned with the pupil acquiring skill and technical knowledge. The physical education program is relied upon to provide opportunity for physical development of the pupil.

Concerning the fundamental principles of his work, Salomon wrote: "...that the work of the children shall be voluntary, never compulsory, that useful objects shall be made and not articles of luxury, that the instruction shall be individual and not by class teaching, that the articles made shall be the property of the children, and never be sold for the benefit of the school, that work shall be interesting, and carefully executed."¹⁹

Salomon has summarized the principles of his method of educational sloyd as follows:

General.

(1) The instruction must go from easy to difficult.

¹⁸Salomon, The Teacher's Hand-Book, op. cit., pp. 21-4.

¹⁹Larsson, Gustaf, "Otto Salomon," Manual Training Magazine, 10:108, December, 1908.

- (2) The instruction must go from simple to complex.
- (3) The instruction must go from the known to the unknown.
- (4) The teaching must lay a good foundation.
- (5) The teaching should possess educational tact.
- (6) The teaching should be interesting in character.

Special.

(7) The instruction should be intuitive in its character, i.e., it should be given as far as possible through the senses, especially touch and sight.

(8) The teaching should be individual in character.

(9) The instructor should be a teacher and not a mere craftsman.²⁰

The educational sloyd courses consisted of a series of models which covered up to eighty-eight motor exercises. It was disciplinary in its aim of developing the mind. Salomon believed that close imitation of the size and form of the models was necessary for dexterity of hand. Consequently, accuracy was emphasized and slight variations were not overlooked when duplicates of the models were made by the pupils.

Otto Salomon considered the knife as the first and fundamental tool. The sloyd knife is found in most industrial arts shops today. However, its use as it was employed in educational sloyd is generally limited to crafts

²⁰Salomon, The Theory of Educational Sloyd, op. cit., p. 10.

courses, usually in the junior high school or upper elementary grades.

The purpose of educational sloyd was to develop the mental, moral and physical powers of the children, not to produce carpenters. The present industrial arts teacher does not expect to develop skilled carpenters, machinists, or other tradesmen. By teaching fundamental tool and machine skills and information related to materials, processes, and occupations, the industrial arts teacher of today strives to meet the aims of general education.

Sloyd was influential in the first establishment of manual training in elementary schools in this country. John M. Ordway of the Massachusetts Institute of Technology visited Sweden in 1882 and brought back much information about Swedish sloyd instruction. However, Gustaf Larsson, who came to Boston in 1888, was considered the real influence of Swedish sloyd in the United States. He gave instruction to public school teachers besides teaching in private schools in Boston. He asserted that Swedish sloyd in the elementary schools of Boston was better than other "manual-training" work. This was disputed by many who considered sloyd as only a part of a good system of industrial arts.

In 1893, three teachers in the Boston schools, Frank M. Leavitt, educated in the fundamentals of the Russian

system, Benjamin F. Eddy, an expert woodworker trained in industry, and Gustaf Larsson, were called together by the superintendent of schools. Each of the teachers was to experiment in his school with the purpose of devising a better method of teaching handwork in the elementary schools. Exhibits from the three schools were sent to the Columbian Exposition in Chicago in 1893. The three methods appeared to be practically the same, with small useful objects as the chief characteristic. "It was recognized that by accepting some of the so-called principles of the Swedish sloyd while continuing to apply some fundamental practices of the Russian system and harmonizing these with the best American practice in the use of woodworking tools, Boston had produced an American system of manual training that was pedagogically sound and practical."²¹ Elementary schools, with manual training as a part of their curriculum, began to increase thereafter with most of them following the trend established in Boston.

Some of the character building and utilitarian aims of educational sloyd are part of the common objectives of present day industrial arts, as summarized by the American Vocational Association. Common objectives of today which are practically the same as some of the aims of educational sloyd are:

...3. Self-realization and Initiative. To develop

²¹Bennett, op. cit., p. 434.

in each pupil the habits of self-reliance and resourcefulness in meeting practical situations.

...5. Health and Safety. To develop in each pupil desirable attitudes and practices with respect to health and safety.

...7. Orderly Performance. To develop in each pupil the habit of orderly, complete, and efficient performance of any task.

...9. Shop Skills and Knowledge. To develop in each pupil a measure of skill in the use of common tools and machines and an understanding of the problems involved in common types of construction and repair.²²

Swedish sloyd was not wholly acceptable in the United States in our system of manual training because it was based on progressive exercises performed with wood. Strict advocates of sloyd training did not want to accept the fact that wood sloyd, as fixed by the philosophy of Otto Salomon, failed to meet the needs of this industrial country. The curriculum for manual training had to be designed for machines and the use of different materials with which industry worked. Larsson believed that the principles of sloyd should not be adapted to this country's existing conditions, but should be adopted in whole and as used in the Scandinavian countries. "The individual teacher, well trained, energetic, thoroughly conscious of the possibilities within himself, can do far more in a community for manual

²²A Guide to Improving Instruction in Industrial Arts, (A Revision of Standards of Attainment in Industrial Arts and Improving Instruction in Industrial Arts), American Vocational Association, Washington: 1953, p. 18.

training than any system."²³ The conclusion was that industrial arts as influenced by industry could "...develop more effectively the powers of precision, skill and accuracy of judgement, love of labor, patience, etc., which are the principal formal aims of the sloyd system."²⁴

While the Russian system was designed to train mechanics and engineers, educational sloyd, in great contrast, was organized for purposes of general education. The Russians emphasized speed in learning; it was a mass production system with engineering results in view. The system of educational sloyd recognized individual capacities and varying speeds in learning. Both the Russians and Swedes used a series of exercises selected by scientific analysis of learning and occupations as known in that day.

Present-day industrial arts adopted the idea of making useful projects as a means by which pupils acquire practical experience in the tool processes. The success of educational sloyd for purposes of general education influenced the thinking of Calvin Woodward and other manual training educators. They realized that manual training should be a part of general education for all rather than for the training of a few for a specific occupation. Otto Salomon thought that an experienced teacher might

²³"The Adaptation of The Sloyd Method To Existing Conditions," Manual Training Magazine, 6:37, October, 1904.

²⁴Farley, op. cit., p. 207.

successfully teach a class of fifteen, eighteen, or twenty pupils.²⁵ Twenty four pupils are generally considered a large group today. He believed that class teaching was more economical, but was not as educational as individual teaching. A characteristic of educational sloyd was that all instruction must be given through individual teaching, following a rigid course of instruction. Individual differences in pupils are recognized today, and the pupil is given individual help. However, the industrial arts teacher usually teaches by class instruction which is then supplemented by individual teaching.

²⁵Bennett, op. cit., p. 69.

CHAPTER III

CALVIN WOODWARD AND MANUAL TRAINING

Dr. Calvin M. Woodward was born in Fitchburg, Massachusetts, August 25, 1837. He graduated at Harvard University in 1860 with the degree of A. B. In 1865, he went to Washington University, St. Louis, Missouri, as assistant principal and teacher of mathematics in the academic department. In 1866, he was made principal of the O'Fallon Polytechnic Institute in St. Louis. In 1868, he was authorized to organize an engineering department for the University. He served as dean until 1896, and, when the School of Engineering and Architecture was reorganized in 1901, he returned to the office of dean and remained at that post until 1910. At that time he resigned in order that he might give more time and attention to his writings.

Dr. Woodward died January 12, 1914.

Being a professor of mathematics, Dr. Woodward had occasion to teach a class in applied mechanics in 1870. In order to make the work more easily understood, he had the college carpenter, Noah Dean, arrange a work area and supervise the construction of working models to illustrate

the mechanical principles that he brought to the attention of his class. It was discovered that the students did not know how to do even the simplest operations with woodworking tools. "Instead of giving up his plan for helping the young men to visualize the fundamental mechanical forms, he proceeded to teach them how to use tools. Thus it was that Professor Woodward was first led to the teaching of shopwork without any direct or immediate trade or industrial motive, although that appeared soon after."²⁶

By 1875, Dr. Woodward's general method of instruction in shopwork was as follows:

A sketch of the piece or task to be constructed is given to a class with all needed dimensions. Each student then makes a careful drawing of it to some convenient scale, with details and exact measurements.

The class then goes to the shop, is furnished with the requisite materials and tools, and each member is shown by an expert how to execute the work. Every piece must be reasonably perfect or it is rejected and a new one is required. Although the students work in the shop no more than four hours a week, the experience is valuable. It is not supposed, of course, that skilled work can be produced by this method, but it is certain that such training will make better judges of workmanship.²⁷

In 1880, Dr. Woodward accomplished what is regarded as his most important work. He was the originator and director of the St. Louis Manual Training School, a private

²⁶Bennett, op. cit., p. 318.

²⁷Ibid., pp. 319-20.

school for boys. "The school, based on a foundation of general education at the scholastic level of the public high school, became the leading educational experiment of its time, and was the model for similar schools to be established in other cities shortly thereafter."²⁸

Dr. Woodward was greatly influenced in his thinking as the result of studying the Russian system of tool instruction as demonstrated at the centennial Exposition at Philadelphia in 1876. Following is a part of Dr. Woodward's philosophy:

It was believed that the school should not be converted into a factory, and that the more it resembled a factory the less it would resemble a school. It was agreed that the commercial idea should be kept out of the shop as much as it was kept out of the chemical laboratory. The science of education should dominate the methods of the drawing-room and the department of biology. In the judgement of this writer this recognition of the science of education was the most valuable feature in the organization of the St. Louis Manual Training School in 1879.²⁹

By the time plans for the St. Louis Manual Training School were devised, Dr. Woodward had a background of considerable experience. In 1900, he gave four distinct reasons for organizing the first manual training school:

- (1) Preparation for a higher technical school-

²⁸Hargitt, George H., "Dr. Calvin Milton Woodward - His Life, Influence, and Place in the Century of Public Education of St. Louis," Industrial Education Magazine, 40:149, May, 1938.

²⁹Woodward, Calvin M., "Education," Harpers Weekly, 44:1129, December, 1900.

A great deal of time could be saved to the student engaged upon the study of civil, mechanical, mining, or electrical engineering, or upon the study of architecture, if he could learn his elementary drawing and get systematic practice in tool-work during the period of secondary education.

(2) Preparation for active work in a mechanical field- It was felt that the boy who expected to be a mechanic in some one of the many trades would greatly profit by a systematic course of instruction and practice in drafting and manual training in the secondary school.

(3) An opportunity for making a judicious choice of occupation- It was found that the great majority of boys stepped out into the world with no adequate knowledge of themselves, so that their choice of occupation, was a matter of whim or environment, with no clear knowledge of natural and inborn fitness.

(4) The enriching of the school curriculum by the introduction of manual features, thereby making it attractive to boys, active physically as well as mentally.- It was believed that the introduction of shop-work and drawing would give such boys an opportunity to consult their tastes, to exercise their powers, and that, as a consequence, school would become attractive, and those who had been called dull and unhappy and troublesome might become bright, happy and successful students.³⁰

Dr. Woodward came to realize that, in the beginning, he had failed to recognize the most important argument for manual training. "What was thought to be particularly valuable for certain classes in the community has been found to be of great value for all... It was not supposed that tool instruction could be made as elementary, analytical, and logical as are the fundamental rules of arith-

³⁰Loc. cit.

metic, but such has proved to be the fact."³¹

As a result of his experience with the students in the St. Louis Manual Training School, Dr. Woodward began emphasizing the general educational value of manual training for all, despite whatever the student's future occupation might be. He frequently made the statement, "put the whole boy to work."³² Dr. Woodward's reasoning was essentially the same as that of today:

Familiar steps and processes are to be combined with new ones in a rational order and for a definite purpose. As a rule, these exercises are carefully chosen and deliberately planned by the instructor. However, at proper times and in reasonable degree- not too early nor too often- pupils are set to forming and executing their own plans. Here is developed not a single faculty, but a combination of many faculties. Memory, comparison, imagination, and a train of reasoning- all are necessary in creating something new out of the old.³³

When the success of the St. Louis Manual Training School was evident, other manual training schools were patterned after it. Smaller communities could not finance separate manual training schools. The first public high school to introduce shop courses was at Peru, Illinois, in 1884.³⁴

³¹Loc. cit.

³²Hargitt, op. cit., p. 149.

³³Woodward, Calvin M., Manual Training In Education, The Walter Scott Publishing Co., New York: 1914, p. 206.

³⁴Bennett, op. cit., p. 389.

The decade from 1880 to 1890 was considered as a period of controversy. Many educators did not recognize the value of manual training in general education and feared the academic standards already established would be broken down. The St. Louis Manual Training School became the center of discussion as were the statements made by Dr. Woodward.

It is evident that Dr. Woodward's manual training school in St. Louis served as a model for the new manual training schools that were established. He was one of the first to fight for the recognition of manual training or manual arts as a part of general education for all.

Some of the reasons for present day industrial arts are traceable to Dr. Woodward's manual training school. Present day industrial arts people believe that experience gained in shop work and drawing saves time for a pupil who later studies in a field of engineering or architecture. A pupil who expects to work in a mechanical field as a mechanic will profit by taking shop work in the secondary school. Tool work experience and drawing in the secondary school industrial arts shop helps the pupil choose an occupation; they help him realize his limitations and capabilities.

A practice of present day industrial arts, which was prevalent in Dr. Woodward's methods of teaching, is

to give instruction by demonstrations and lectures, using models, charts, and the blackboard. Class instruction is given and is supplemented by individual help. Additional problems are arranged for the brighter and quicker members of a class. Teachers of today realize that the length of time required for completion of a problem varies considerably in a class. Instruction is given by teaching principles, and helping the pupil acquire skill in tool techniques. The pupil makes useful articles which are kept in his possession when they are completed rather than producing items for sale as was done in the Russian schools. These experiences help develop the pupil into a useful, happy, and successful citizen.

CHAPTER IV

SELVIDGE AND TRADE AND JOB ANALYSIS

Robert W. Selvidge was born at Montview, Missouri, August 11, 1872. He taught in the rural and village schools in Missouri from 1890 to 1895 and was county superintendent of schools, Johnson County, Warrensburg, Missouri, from 1895 to 1897. He organized the department of industrial education at the University of Missouri, Columbia, from 1908 to 1913, and Peabody College, Nashville, Tennessee, from 1913 to 1919. He was with the University of Missouri from 1919 to 1941. Professor Selvidge was the author of Individual Instruction Sheets, and How to Teach a Trade. He was co-author of Principles of Trade and Industrial Teaching. He has written a series of instruction manuals and other publications.

Trade and job analysis has been spoken of as an inventory procedure for instructional purposes. "Units of instruction are of two major kinds; namely, things that must be done and things that must be known by the trained worker. The former refers to manipulative or machine performance; the latter refers to mental functions related to

the work."³⁵

The most noteworthy contribution to industrial education by Robert W. Selvidge was his trade and job analysis.

His emphasis upon the necessity of discovering or determining "what the learner needs to know and to be able to do" before other steps can be taken has transformed the work of the teacher in other fields as well as ours. His analysis of the various shop subjects into "learning units", and his insistence that every project and every experience should be analyzed to determine just what the learner is expected to learn, have been revolutionary in their contribution to the improvement of teaching.³⁶

As early as 1929, Dr. Selvidge felt that there are certain fundamental skills, attitudes, and habits that are common to many different types of work. He felt that these values could be developed in one type of work almost as well as in another, and emphasis should be placed upon the things we wish to teach rather than upon the things we wish to make. In 1942, William Bawden wrote that Dr. Selvidge had formulated objectives of the industrial arts teacher which had been accepted more than anything else that had appeared on that subject.³⁷ Dr. Selvidge formulated the following objectives in 1929.

³⁵Fryklund, Verne C., "What is Information in Trade and Job Analysis," Industrial Arts and Vocational Education, 29:400, December, 1940.

³⁶Bawden, William T., "Tribute to Professor Selvidge," Industrial Arts and Vocational Education, 31:40, January, 1942.

³⁷Loc. cit.

The work should be selected, organized, and planned so as to provide a training that will give us boys who have:

- (1) A well developed interest in industrial affairs.
- (2) A knowledge of some of the elementary principles of science that affect the functioning of the things we use.
- (3) An appreciation of good workmanship and design.
- (4) An attitude of pride or interest in his ability to do things.
- (5) A feeling of self-reliance or confidence in his ability to take care of himself in an unusual situation.
- (6) A habit of orderly and methodical procedure in the performance of any task.
- (7) Elementary skills in the use of the more common tools and machines and in methods of modifying and handling materials, in order to make them conform to our use.³⁸

Dr. Selvidge wrote the following concerning trade and job analysis:

...each job or duty usually contains a number of learning units which are found in identical form in many other jobs or duties, but arranged in somewhat different order and involved in different situations. In our analysis it is these learning units we seek...

In our analysis we must seek the things that one must learn and the habits he must establish in order that he may be a worthy member of the craft to which he seeks admission...

One of the most common errors of those who attempt

³⁸Selvidge, Robert W., "What Shall We Teach," Industrial Education Magazine, 31:43-5, August, 1929.

to make such an analysis is to make a topical outline. Such an outline is very good as a basis for a lecture, but it is not a satisfactory method of listing the learning units of a vocation.

...In those things involving skill or doing, the item should be so stated as to suggest action.

...It will be observed that the terms "Batter-boards" and "Drains" give no suggestion as to what is to be taught or learned concerning them, while the statement, "How to set batter-boards," or "How to put in a footing-drain," gives something specific to teach and to learn.³⁹

By 1929, Dr. Selvidge was advocating written instruction sheets for use in industrial education classes. He believed they were the best answer to the problem of individual oral instruction, a method which required too much time and was unreasonable in cost. He realized the necessity for concentrated planning if written instruction sheets were to be satisfactory.

A written instruction must be clear, brief, and exact. It must be clear because many pupils do not get information readily from the printed page, and care should be taken to remove every obscurity, if possible. It should be brief because every unnecessary word tends to confuse and distract the attention from the main point. It must be exact because it is the only guide, and the one who uses it must have complete confidence in it.⁴⁰

He felt that the reason many teachers had difficulty

³⁹Selvidge, Robert W., "Principles and Purposes of Vocational Analysis," Industrial Education Magazine, 32:251, February, 1931.

⁴⁰Selvidge, Robert W., "Types of Written Instruction Sheets," Industrial Education Magazine, 30:235, January, 1929.

in preparing satisfactory written instruction material was because they did not recognize the fact that different kinds of instruction require different methods of procedure. He asserted that developing skill requires a method of procedure quite different from that required in the development of thought and reasoning. He used the term "Instruction Sheet" as a general term which included all forms of written instruction material.

In April, 1931, the A. V. A. Committee on Standards of Attainment in Industrial-Arts Teaching, invited Dr. Selvidge to take the leadership in analyzing and organizing the fundamental units of instruction for the various trade and industrial arts subjects. Two magazines, the Industrial Education Magazine and the Industrial Arts and Vocational Education magazine, agreed to help in promoting the investigation. Dr. Selvidge devised what was called a "Plan for Cooperative Analysis of Trade and Industrial-Arts Subjects."⁴¹

The two magazines published the following plan which was proposed by Dr. Selvidge:

1. That every teacher who is interested in such

⁴¹Selvidge, Robert W. "Plan for Cooperative Analysis of Trade and Industrial-Arts Subjects," Industrial Education Magazine, 32:344-5, April, 1931.

an analysis join in this undertaking.

2. That we analyze all industrial-arts subjects, as taught in the high school, for the learning units involved.

3. That we analyze the principal skilled trades for the learning units involved.

4. That tentative analyses of the selected subjects, or trades, be published and distributed as rapidly as may seem practicable.

5. That any shop teacher or supervisor who is willing to cooperate, or to offer suggestions in the way of modifying, adding to, or taking away from the original list, should send such suggestions or comments...

6. That the suggestions thus received be carefully studied, edited, and incorporated so far as possible into the original lists; and that the revised list be published, together with the names of those who cooperate.

7. That those who are interested send in the analysis of any subject, or trade, which they have prepared, which may be used by the Committee as the basis of the preliminary analysis...⁴²

Dr. Selvidge prepared a list of learning units in woodworking, sheet metal work, home mechanics, cement and concrete work, elementary electricity for high school, mechanical drawing, and general metal work. The lists of learning units were divided into three groups: "The Things You Should Be Able To Do," "The Things You Should Know," and "The Things You Should Be." In his tentative analysis of each of the subjects was presented a list of desirable

⁴²Loc cit.

habits and attitudes which contributed to success in life. The list, entitled "The Things You Should Be," contained the following: (1) Industry; (2) Cooperation; (3) Consideration of others; (4) Self-reliance; and (5) Readiness to assume responsibility. The lists were published by the Industrial Education Magazine and the Industrial Arts and Vocational Education magazine in 1932. Reprints of the "Learning Units" were made available to anyone who wanted copies.

The American Vocational Association Committee printed a 92 page booklet in 1934 entitled Standards of Attainment in Industrial Arts Teaching. Its purpose was to serve as a guide for improving the programs of industrial arts by utilizing Dr. Selvidge's analyses of trade and industrial arts subjects. The demand for the 92 page booklet was so great that eight printings were made before it was revised in 1946. "It is probable that no other publication in the field of industrial arts was used by so many teachers and administrators. Certainly none exerted equal significant influence upon the progress of industrial arts in public education throughout the country."⁴³

Dr. Selvidge did his important work in analyzing industrial arts subjects at the time the general shop was being introduced into many school curriculums. Instruction sheets and the analysis of industrial arts

^{43A} Guide To Improving Instruction In Industrial Arts, op. cit., p. 101.

subjects were extremely valuable to the teachers who had previously taught in only one subject area.

Della Vos first analyzed tool processes into elements and taught them through a series of graded exercises. Otto Salomon incorporated the practice of analyzing tool processes into educational sloyd, but had the pupil gain practical experience in working with tools by making a series of models which were useful articles to be retained by the pupil. Calvin M. Woodward was among the first in the United States to utilize parts of both the systems of Della Vos and Otto Salomon in connection with his own ideas of manual training and to establish it as a part of general education. Dr. Selvidge analyzed individual trades, jobs, and processes, and developed instruction sheets for the purpose of improving and facilitating instruction of large numbers taught primarily by group instruction as well as for the faster progress of individuals in areas where instruction sheets were practicable. He lived well into the present phase of industrial arts, and his method of analyzing learning units has not changed much since he first used it in the 1930's. As industrial machines and processes increased and developed, Dr. Selvidge was a leader in the analysis of these new tools, machines, and processes as they were introduced into school industrial arts and vocational shops.

CHAPTER V

WILLIAM E. WARNER AND THE LABORATORY OF INDUSTRIES

Dr. William E. Warner received his high school and teachers college training in the State Teachers College, Platteville, Wisconsin. He received a diploma to teach shopwork in 1917. He entered the University of Wisconsin in 1920, received his Bachelor of Science degree in 1923, and obtained his Master of Science degree in 1924. He was appointed assistant professor of industrial arts education at Ohio State University in 1925, and obtained his Doctor's degree in 1928.

Dr. Warner is credited as being the first to refer to the general shop as a "Laboratory of Industries." Arthur B. Mays writes that in 1930, Dr. Warner wrote an article in which he used the term "General Laboratory of Industries."⁴⁴ A laboratory of industries is generally considered to be an outgrowth of household mechanics or

⁴⁴Mays, Arthur B., Notes on the Historical Aspects of the General shop, (Reprint from Industrial Arts and Vocational Education,) April, 1950, p. 7.

the general shop, one difference being that it offers a wider range of industrial experiences.⁴⁵

The term "general shop" came into gradual use, and the origin of its first use is vague. Its first appearance was in the title of an article in the Industrial Education Magazine in 1923.⁴⁶ It had probably been used much earlier than 1923. Dr. Arthur B. Mays writes that originally the general shop was the industrial-education phase of the junior high school movement. Stress on the concept of occupational exploration as an objective led educational leaders to believe that the wood and metal shops of the large schools and the single wood shop of the smaller schools inadequately attained this purpose. Household mechanics later became a term used synonymously with general shop.⁴⁷

In 1928, Dr. Warner spoke of five kinds of educational activities which should be included in a well-organized "industrial arts laboratory."

They include experimentation, investigation, construction, observation, and purposeful reading and discussion. These five activities constitute a broader and more modern program than that used in the earlier period of manual training where articles were made

⁴⁵Harrison, Paul E., "A Laboratory of Industries," Industrial Arts and Vocational Education, 29:260, September, 1940.

⁴⁶Mays, op. cit., pp. 6-7.

⁴⁷Loc. cit.

in order that the hand could be trained in the tool skills - mainly with woodworking tools⁴⁸

In 1930, Dr. Warner spoke of a "comprehensive general shop program which would permit the training of machinists, automotive mechanics, electricians, patternmakers and woodworkers."⁴⁹ He wrote a series of articles entitled "Establishing The General Shop," which were published by the Industrial Arts and Vocational Education Magazine in 1930. He expressed the idea that tool experiences involving more than a single area of materials were desirable. He suggested that the making of a modern lamp would involve electricity, woodwork, design, drawing, glasswork, finishing and its placement in a room. He cautioned against too rapid development of this theory in actual practice. Because of the inadequacy of teachers who were used to teaching in one subject area only, usually woodwork, Dr. Warner believed that it would take from five to ten years to develop a good general shop.⁵⁰ He suggested that the objectives of the general shop should chiefly concern avo-

⁴⁸ Warner, William E., "Activities Centered Around The General Industrial-Arts Laboratory," Educational Research Bulletin, 7:15-7, January, 1928.

⁴⁹ Warner, William E., "Establishing The General Shop," Industrial Arts and Vocational Education, 19:287-90, August, 1930.

⁵⁰ Warner, William E., "Establishing The General Shop IV," Industrial Arts and Vocational Education, 23:31-8, February, 1934.

cational interests, consumer knowledges and appreciations for industrial products, occupational exploration, guidance, specific manual abilities, and social habits and attitudes. From 1928 to 1934, he worked in school shop planning, and contributed much information concerning the planning of general shops. He did research work on problems such as shop location, shop size and shape, principal units to be included in the program, auxiliary facilities such as storage and lockers, and equipment provisions.⁵¹ His work in general shop planning is considered by many as very influential in the establishment and growth of the general shop movement.

By early 1934, Dr. Warner had organized a chart which was referred to as "The circle-chart analysis."⁵² He believed children and adults "...have a lot to do with consuming, producing, and enjoying the technological economy with which America is so richly favored and Industrial Arts does so little."⁵³ He spoke of the "dilemma" of industrial arts, the transition from handicrafts to technology. The "circle-chart analysis" was for the purpose of analyzing the work of different industries in wood,

⁵¹Warner, William E., "Studies in School Shop Planning," Industrial Arts and Vocational Education, 23:31-8, February, 1934.

⁵²Warner, William E., A Perspective of Industrial Arts, A Discussion of the Chart Analysis, Ohio State University, Columbus: 1934, pp. 2-3.

⁵³Warner, William E., The Industrial Arts Curriculum-Development of a Program to Reflect American Technology, Epsilon Pi Tau, Columbus: 1953, p. 3.

metal, ceramics, printing, automotives or transportation, electricity, planning and personnel. All the subject matter to be included would be integrated in a child-centered program to meet physical and social needs of the children. Aims or objectives would be established for controlling or evaluating the industrial arts curriculum.⁵⁴ The "circle-chart analysis" caused teachers to analyze their work, and led to further development of the comprehensive general shop.

Dr. Warner wrote the following in 1936, concerning his interpretation of industrial arts.

Objectives of "Exploration," "Avocation," and "Intelligent consumption" pretty well define the principle of scope of industrial arts in the secondary school, large or small. There are other objectives, of course, and the point of emphasis will vary, but these three will or should dominate any program.

...Areas or types of industrial-arts content deemed basic in the secondary school to meet the requirements of the antecedents described earlier will include: drawing or planning (sometimes narrowly referred to in this connection as engineering, mechanical, or instrument drawing); graphic arts (too frequently limited to letter-press printing); ceramics (if it is not restricted to the industry referred to as art pottery); wood and metal industries; transportation, including automotives and aviation; communication, including electrical service, lighting, telegraphy, and radio; along with textiles, including clothing studies and weaving; foods from the consumer as well as the producer angle; along with certain minor areas such as consumer arts and crafts as leather tooling, all of which the general philosophy presented

⁵⁴Collicott, J. G., and Skinner, B. O., A Prospectus For Industrial Arts In Ohio, Ohio Education Association and the State Department of Education, Columbus: 1934, pp. 15-9.

above will require if applied.

...Permit me to be more explicit by reviewing that in the drawing and planning area of a secondary school's laboratory of industries the problems should include, ...experiences dealing with layouts, lettering, shape description, pictorial drawing, descriptive drawing, color, design, working drawings or plans including furniture and architectural drawing, duplicating map drawing, charts and graphs, block printing, commercial art, etching, chalk talking, and cartooning.

...it would seem that any phase of the industrial arts program could be evaluated in a school or community by considering its ability to touch on the extent of American industry (exploration), to provide experiences for a worth-while leisure (avocational interests), to develop more intelligent consumption (consumer knowledges and appreciations), to provoke individual growth (personal-social trait development), to cultivate the aesthetic or artistic side of life, and to find out about the occupational realm, a side of economic society so important to everyone.⁵⁵

Three years later, he said further:

There is a distinct trend toward a functional type, in contrast to the old means type as illustrated by such industrial-arts curriculum classifications as power, records, transportation, housing, and the like, in contrast to electricity, printing, auto mechanics, woodworking, and mechanical drawing,...⁵⁶

After World War II, The American Industrial Arts Association published a "new type" definition for indus-

⁵⁵ Warner, William E., "How Do You Interpret Industrial Arts?," Industrial Arts and Vocational Education, 25:34-5, February, 1936.

⁵⁶ Warner, William E., "On Coming Of Age," Industrial Arts and Vocational Education, 28:7, January, 1939.

trial arts. Dr. Warner has been closely associated with the American Industrial Arts Association. His philosophy of industrial arts is reflected in the new definition which is as follows:

1. Functionally, Industrial Arts as a general and fundamental school subject in a free society is concerned with providing experiences that will help persons of all ages and both sexes to profit by the technology, because all are involved as consumers, many as producers, and there are countless recreational opportunities for all.

2. In Scope, the emphasis at childhood or elementary school levels is in providing the basis or means for integrated activity programs; at early adolescent or junior high school levels in providing the orientation program concerning the technology; at later adolescent or senior high school levels in providing specialized elements of the technical program and a sound basis for a possible industrial-vocational education; at young adult or collegiate levels in providing technological studies and activities of consumption, production, and recreation in the core program, and elements of technical training in the terminal program; and at later adult levels in providing recreational and consumer activities for all, along with elements of the technical as required.

3. Content in the new Industrial Arts curriculum is derived via a socio-economic analysis of the technology and not by job or trade analysis as of old from the commoner village trades such as those of the carpenter, the blacksmith, the cabinet maker, ... Now, the subject matter classifications are conceived of as including:

a. Construction: simple fabrication, housing, public works, industrial, national defence, ...

b. Manufacturing: includes the basic industrial methods of changing raw materials into finished products such as foods, textiles, ceramics, metals, woods, plastics, and leathers, similar but broader in concept and application

that has been developed in the so-called "general" shop of the past thirty years;

c. Power: tidal, solar, atomic, electrical, muscular, hydraulic, combustion, ...;

d. Transportation: land, sea and air;

e. Communications: graphic arts including drawing, letter-press, planography, intaglio, and the miscellaneous processes in addition to electricity, electronics, and other communications media; and

f. Personnel Management: including line and staff as in American business and industry, and labor as well as management.

4. Methods involve a full gamut including: planning, the work experience as a means to an end, field study, personnel and physical organization, illustrative aids, conferences, creative expression, ...

5. Physical settings as regards equipment and facilities must echo the principal elements of technology: its development and uses of power, its transportation, its construction, including housing and home furnishing, its communication even including the use of such specialized techniques as radar, and its basic types of manufacture.

6. Historically, Industrial Arts is as old as parental training for survival among the primitives, but it is intrinsically general or educational rather than vocational because it reflects the economy and not necessarily any particular or specialized employment, any more than the study of English composition is expected to result in journalism. Many other subjects such as language, science, art, music, and certainly economics and history, have long found that Industrial Arts is able to contribute richly to the substance of their realism.⁵⁷

Some of Dr. Warner's ideas of a laboratory of industries became incorporated in a few industrial arts programs

⁵⁷ Warner, William E., The Industrial Arts Curriculum-Development of a Program to Reflect American Technology, op. cit., pp. 5-6.

GRAPHIC REPRESENTATION OF THE CONSTRUCTION DIVISION

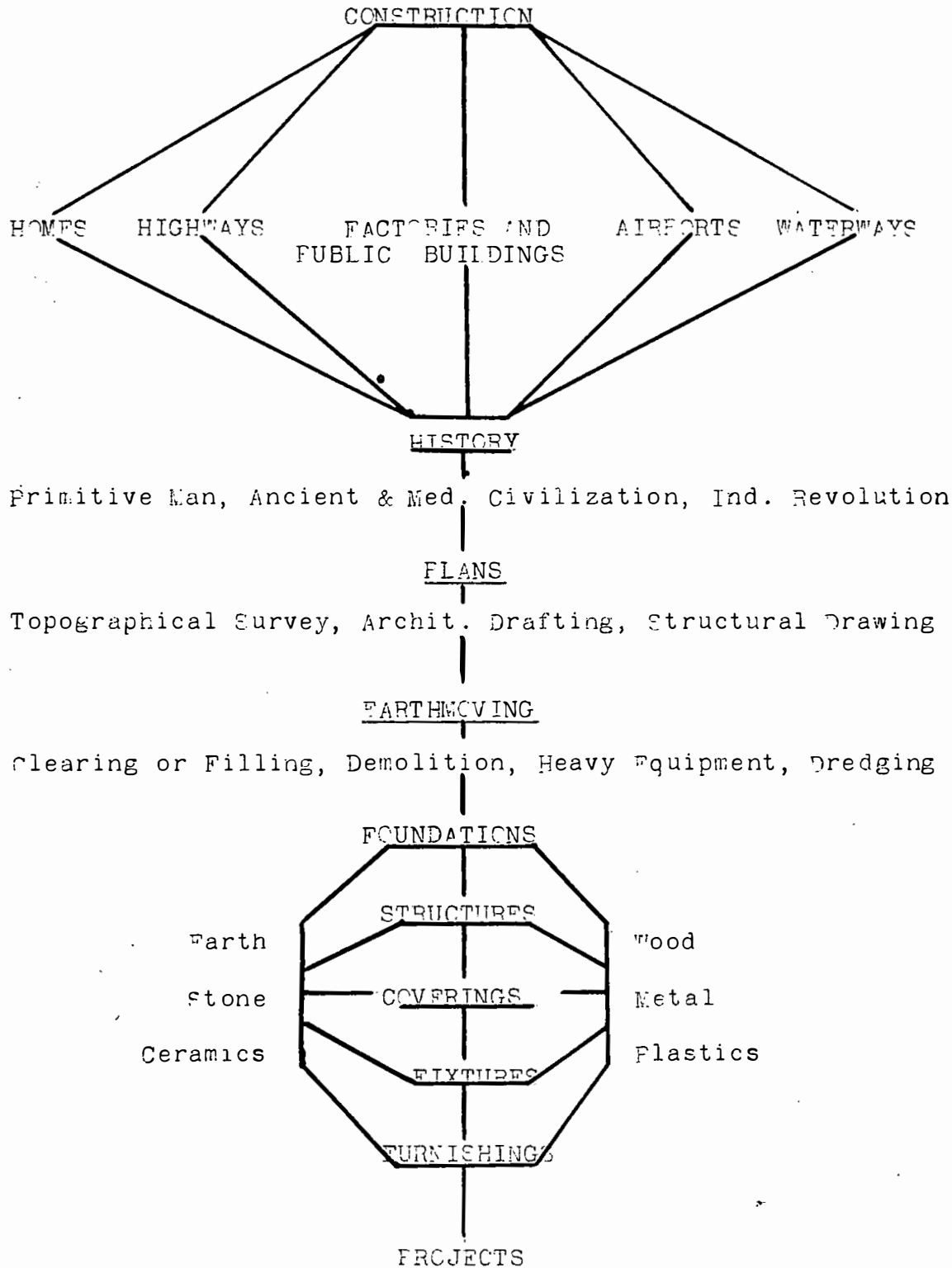


Figure 1

MAJOR FACTORS IN THE STUDY OF POWER

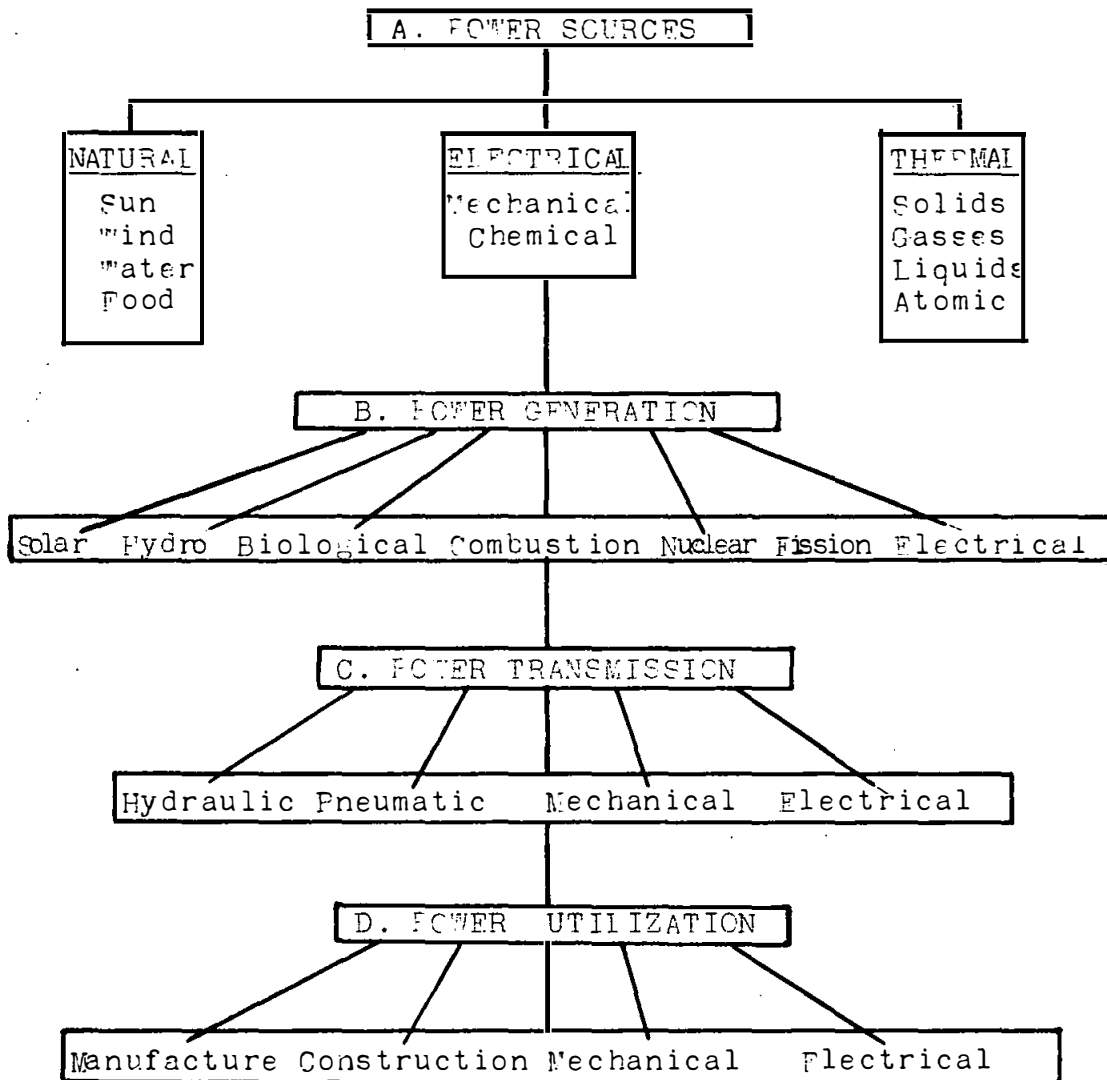


Figure 2

THE TRANSPORTATION DIVISION
A Graphic Analysis of Content

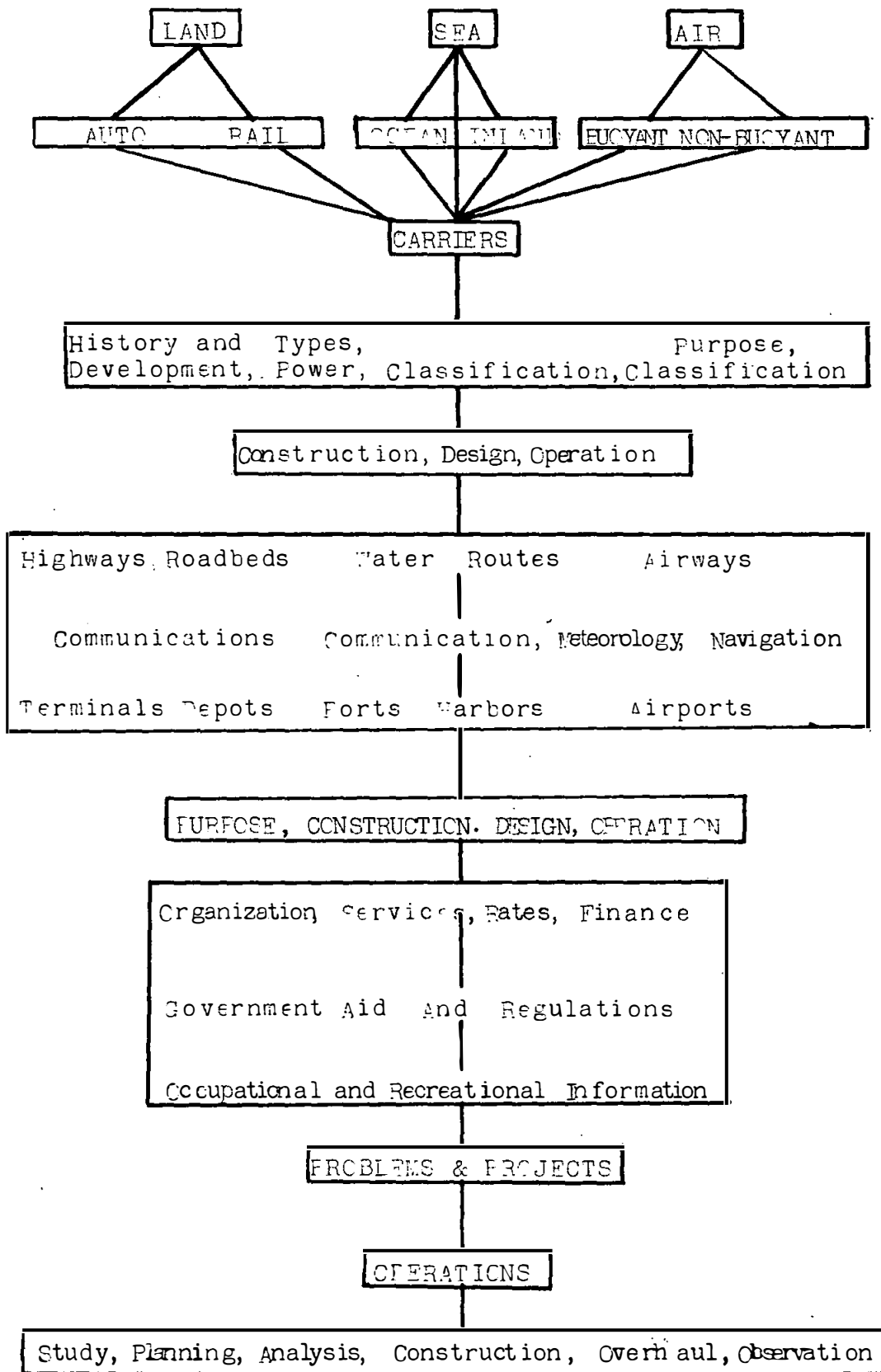


Figure 3

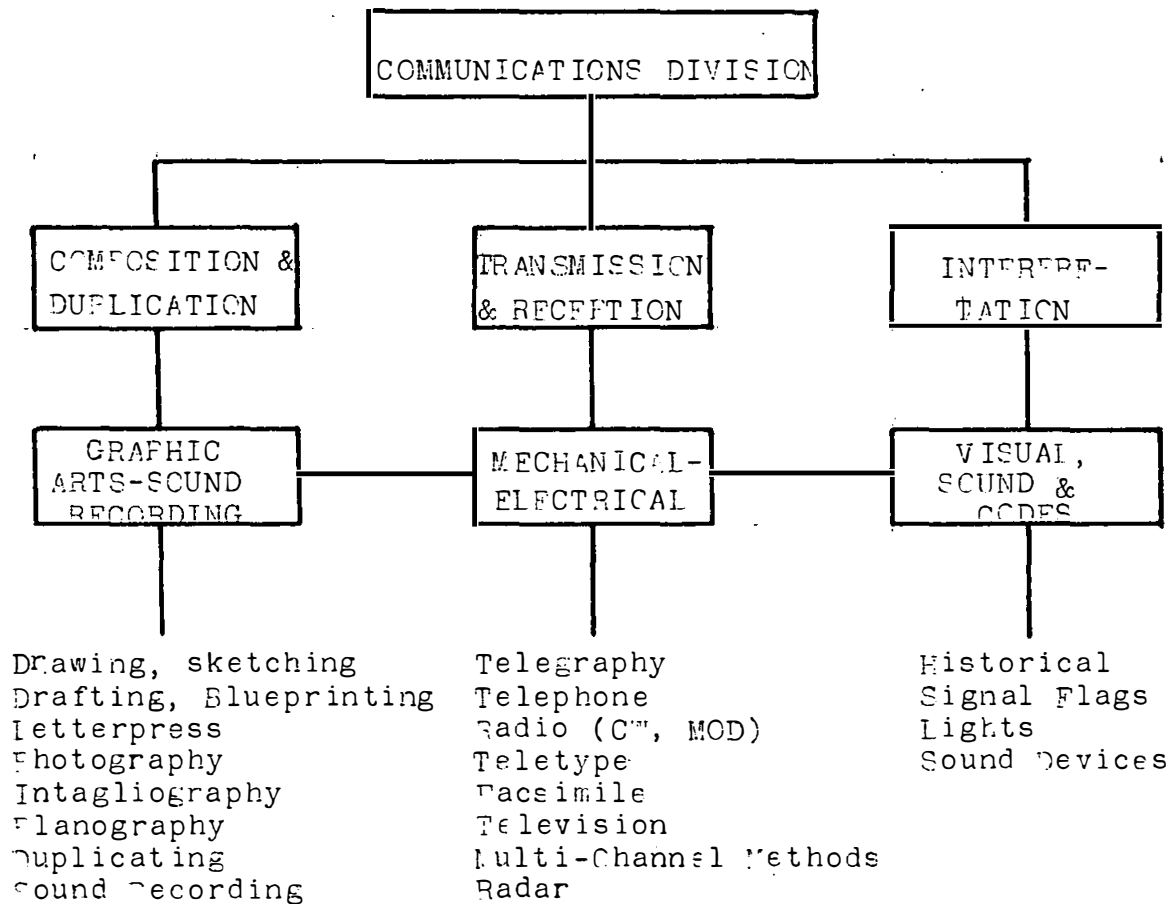


Figure 4

in the late 1930's. By 1941, for example, the Chicago schools had developed a laboratory of arts and industries which included instructional areas in plastics, graphic arts, metals, power, communication, woods, transportation, and planning. It was provided for boys who wanted to elect advanced shop work as a part of their education but did not want to take a straight technical or vocational course. 58

The shop was divided into three major divisions under the supervision of two teachers. It had a separate planning center equipped for visual education, demonstrations, and reference reading. One half of the area was equipped for working plastics, woods, and graphic arts under one teacher. The other half was equipped for working metals, communication, transportation, and power, under the direction of the second teacher.

About 75 per cent of the time was spent learning the use of materials, tools, and machines. The remaining fourth of the time was devoted to related activities which included well-planned trips to industry, motion pictures, reference reading, demonstrations of tools and materials, planning discussions, related reading, and making drawings for construction activities.

58 Johnson, William H., "Laboratory of Arts and Industries," Industrial Arts and Vocational Education, 30:83, March, 1941.

Dr. Warner emphasizes extensive teaching of technology in the many phases of industry. He believes there should be more teaching with books, with emphasis on consuming, producing, and enjoying our technical economy. In 1953, he wrote that "...it should be obvious that American technology needs to be faced by education and that simple manual or craft classifications no longer suffice..."⁵⁹ His contributions to the development of the general shop have been extensive. Although the Laboratory of Industries idea has been to the fore in the philosophy of some of Dr. Warner's followers during the past fifteen years, many leaders in industrial arts education have not been convinced that major emphasis on technology is the solution for industrial arts in general education.

⁵⁹ Warner, William E., The Industrial Arts Curriculum, Development of A Program To Reflect American Technology, op. cit., p. 3.

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